

depth. However, Deutsch and Ramachandran's example of a crumpled newspaper clearly shows that this is not the only factor involved. In this case there is an abundance of high contrast local disparity information provided by the printed letters, yet the pseudoscopic image cannot be reversed in depth. This is also true if the words and letters are completely unintelligible. Likewise, pseudoscopic viewing of the normal face of our original figure 5 (1), upside-down or partially covered, does not make the nose reverse. We therefore feel confident that the binocular interpretation of texture perspective (2) and not familiarity counter-

acts binocular depth reversals.

AAD VAN DEN ENDEN

HENK SPEKREIJSE

*The Netherlands Ophthalmic Research Institute,
Post Office Box 12141,
1100 AC Amsterdam-ZO, The Netherlands*

NOTES

1. Note that the legends of our original figures 5 and 6 were interchanged. Red/green glasses can be obtained from us at no cost.
2. Although texture perspective is known as a monocular depth cue, it is different for the left and right eye and so has a real binocular disparity.

29 August 1989; accepted 3 April 1990

HIP-70: An Isoform of Phosphoinositol-Specific Phospholipase C- α

We recently reported that estrogen and luteinizing hormone-releasing hormone (LH-RH) induce the same protein, which we referred to as HIP-70 (1). Although repeated searches on Genbank before our report was submitted revealed no sequence similarities between the NH₂-terminus of HIP-70 and any other sequence, more recent searches on Genbank revealed an identity (first brought to our attention by M. Christensen) with the NH₂-terminus of a phosphoinositide-specific phospholipase C (PI-PLC) isoenzyme (2). This PI-PLC isoenzyme, whose sequence became available in a 15 September 1989 release from Genbank is now referred to as PLC- α (3). PLC- α is one of a family of enzymes that generate the phosphoinositide-derived messenger molecules, including the arachidonic acid metabolites, diacylglycerol (which activate protein kinase C) and inositol 1,4,5-triphosphate (which mobilizes intracellular calcium) (3). Neither HIP-70 nor PLC- α have any significant sequence similarities with the three other known mammalian PI-PLC isoenzymes (3). The rat liver form of this protein migrates on SDS gels with an apparent molecular weight of 68 kD (4), consistent with the migration of HIP-70. We suggested that hormonal induction of HIP-70 occurs by modification (probably dephosphorylation) of a more acidic isoform with the same NH₂-terminal sequence (1), which is consistent with the hypothesis that phosphorylation may attenuate the activation of PLC- α (5). HIP-70 seems to be the most basic of four isoforms from brain that are recognized by an antibody to PLC- α (6).

That PLC- α plays a major role in estrogen- and LH-RH-regulated neuronal function is consistent with several additional observations. (i) PLC- α mRNA is especially

abundant in the ventromedial hypothalamus and preoptic areas, which are rich in estrogen receptors and mediate effects of estrogen; mRNAs of three other PLC isoforms were undetected in these regions (7); (ii) PLC activation leads to activation of protein kinase C; we have shown that phorbol esters, which also activate protein kinase C, facilitate lordosis (8); (iii) LH-RH and substance P both facilitate the estrogen-regulated behavior lordosis (9), and the phosphoinositol pathway is implicated in mediating effects of these peptides (10). We therefore propose that HIP-70 is a specific hormone-induced isoform of the phosphoinositol-specific phospholipase C isoenzyme, PLC- α .

CHARLES V. MOBBS

*Department of Neurobiology and Behavior,
Rockefeller University,
New York, NY 10021*

GEORGE FINK

*Medical Research Council,
Brain Metabolism Unit,
University Department of Pharmacology,
Edinburgh University,
1 George Square,
Edinburgh EH8 9JZ,
Scotland, United Kingdom*

DONALD W. PFAFF

*Department of Neurobiology and Behavior,
Rockefeller University,
New York, NY 10021*

REFERENCES

1. C. V. Mobbs, G. Fink, D. W. Pfaff, *Science* **247**, 1477 (1990).
2. C. F. Bennett, J. M. Balcarek, A. Varrichio, S. T. Crooke, *Nature* **334**, 268 (1988).
3. S. G. Rhee, P.-G. Suh, S.-H. Ryu, S. Y. Lee, *Science* **244**, 546 (1989).
4. T. Takenawa and Y. Nagai, *J. Biol. Chem.* **256**, 6769 (1981).
5. S. T. Crooke and C. F. Bennett, *Cell Calcium* **10**,

309 (1989).

6. C. V. Mobbs, G. Fink, D. W. Pfaff, in preparation.
7. C. A. Ross, M. W. MacCumber, G. E. Glatt, S. H. Snyder, *Proc. Natl. Acad. Sci. U.S.A.* **86**, 2923 (1989).
8. C. V. Mobbs, J. M. Rothfeld, R. Saluja, D. W. Pfaff, *Pharm. Biochem. Behav.* **34**, 665 (1989).
9. Y. Sakuma and D. W. Pfaff, *Nature* **283**, 566 (1980); W. A. Dornan, C. W. Malsbury, R. B. Penney, *Neuroendocrinology* **45**, 498 (1987).
10. R. Mitchell, M. Johnson, S.-A. Ogier, G. Fink, *J. Endocr.* **119**, 293 (1988); P. W. Mantyh, R. D. Pinnock, C. P. Downes, M. Goedert, S. P. Hunt, *Nature* **309**, 795 (1984).
11. Supported by a grant from the National Science Foundation (BNS-8716032) to C.V.M.

30 April 1990; accepted 22 May 1990

The report by C. V. Mobbs *et al.* (1) on the estrogen induction of the HIP-70 protein in the brain may open more lines of investigation on estrogen regulation of metabolic pathways, as we find that the sequence given exactly matches that of the rat type I phosphoinositide-specific phospholipase C isozyme (2, 3), a signal transduction component. This sequence has been in the Protein Identification Resource's Protein Sequence Database (PIR-PSDB) since 31 March 1989.

By searching the PIR-PSDB, Bennett *et al.* (2) had earlier found two thioredoxin-like domains in this phospholipase C isozyme, leading them to suggest possible regulatory or catalytic roles for these domains. Another protein containing two domains homologous to thioredoxin is protein disulfide isomerase, a microsomal enzyme catalyzing thiol-disulfide exchange reactions in proteins. While investigating the *in vitro* degradation of insulin by protein disulfide isomerase and its inhibition by estrogens, we found that a 44-residue segment of this enzyme, which corresponds to exon 3 of the human gene (4), has significant similarity with a segment in the estrogen-binding domain of the estrogen receptor (5). We proposed that (i) this region of the enzyme interacts with estrogens, causing a change in the enzyme's catalytic site, and that (ii) only a segment in the steroid-binding domain of each receptor determines its steroid specificity. When this phospholipase C isozyme sequence was published (2, 3), we compared it with that of protein disulfide isomerase and found that the two proteins are similar along their entire lengths, especially in the thioredoxin domains and in the proposed estrogen-binding region (5), and likely derive from a common ancestral gene. The activity of this phospholipase C isozyme might be directly affected by estrogens, especially during human pregnancy, when estrogens reach micromolar concentrations. The work of Mobbs *et al.* (1) provides strong evidence for a functional relationship between estrogens and this phospholipase C isozyme.

WINONA C. BARKER
 LOIS T. HUNT
*National Biomedical Research Foundation,
 3900 Reservoir Road, NW,
 Washington, DC 20007*
 JOHN C. M. TSIBRIS
 WILLIAM N. SPELLACY

*Department of Obstetrics and Gynecology,
 University of South Florida,
 Tampa, FL 33606*

REFERENCES

1. C. V. Mobbs, G. Fink, D. W. Pfaff, *Science* **247**, 1477 (1990).
2. C. F. Bennett, J. H. Balcerek, A. Varrichio, S. T. Crooke, *Nature* **334**, 268 (1988).
3. S. G. Rhee, P.-G. Suh, S.-H. Ryu, S. Y. Lee, *Science* **244**, 546 (1989).
4. K. Tasanen, T. Parkkonen, L. T. Chow, K. I. Kivirikko, T. Pihlajaniemi, *J. Biol. Chem.* **263**, 16218 (1988).
5. J. C. M. Tsibris *et al.*, *ibid.* **264**, 13967 (1989).

9 April 1990; accepted 22 May 1990



"On some, my right brain says they're good art, but my left brain says they're bad investments. On others, my right brain says they're bad art, but my left brain says they're good investments."